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ROLAND HARMES, Director

J. Kuens  
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*This is strictly  
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EPA Region 5 Records Ctr.



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August 6, 1993

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OFFICE OF SUPERFUND  
ASSOCIATE  
DIVISION DIRECTOR

Mr. Valdas V. Adamkus, R-19J  
Administrator, Region 5  
U.S. Environmental Protection Agency  
77 West Jackson Boulevard  
Chicago, Illinois 60604-3590

Dear Mr. Adamkus:

On behalf of the State of Michigan, we are pleased to sign the attached Close-Out Report for the Charlevoix Municipal Well site, Charlevoix, Michigan, which signifies the successful completion of the project as described in the Record of Decision.

It has been a pleasure working cooperatively with the U.S. Environmental Protection Agency through the completion of this project, providing the City of Charlevoix with a safe and reliable source of drinking water. We look forward to many more mutual successes, such as this, in the Superfund program.

Sincerely,

*[Signature]*  
Roland Harmes  
Director  
517-373-2329  
**ACTING**

Attachment

cc: Mr. Alan J. Howard, MDNR

**Superfund Site Close-Out Report  
Charlevoix Municipal Well  
Charlevoix, Michigan**

**I. SUMMARY OF SITE CONDITIONS**

Background

The City of Charlevoix is located in the northwest part of the lower peninsula of Michigan on the shore of Lake Michigan. The Charlevoix municipal well supplied potable water to a year-round population of 3,500 which increased to approximately 5,000 during the summer tourist season. The municipal well consisted of a shallow large-diameter clear well connected to two 225 foot long horizontal flumes which were buried beneath the Lake Michigan parallel to the shoreline. The flumes collected water from Lake Michigan and from groundwater in approximately equal amounts.

Remedial Planning Activities

In September 1981, while conducting tests for tri-halogenated methane compounds in the City's chlorinated water supply, the Michigan Department of Public Health (MDPH) detected trichloroethene (TCE) ranging in concentration from 13  $\mu\text{g/l}$  to 30  $\mu\text{g/l}$  in samples taken at the tap. Subsequently, a monitoring system was put into place and continued to detect gradually rising levels of TCE at the well. In December 1982, concentrations of TCE exceeded 100  $\mu\text{g/l}$  at the well. At that point, the City installed an emergency diffused aeration system in the caisson to remove some of the TCE. Based on water quality data, the aeration system was able to remove 30 to 40 percent of the TCE. With this measure operating, concentrations of TCE in the water supply system were generally kept below 50  $\mu\text{g/l}$ .

In June and July 1982, the EPA's Technical Assistance Team (TAT) drilled 13 test wells in the vicinity of the municipal well without locating the source of the contamination. Sampling of the test wells found varying concentrations of TCE and perchloroethene (PCE). The PCE was detected in the monitoring wells only and was not found in the City's water supply. Charlevoix was proposed for the National Priorities List (NPL) in December 1982, and was finalized on the NPL in September 1983.

The Remedial Investigation (RI) of the Charlevoix site began in September 1983. Preliminary field work began in September and was completed in December with the installation and sampling of 12 borings and monitoring wells. The second major phase of field work began in July 1984 and included soil borings, monitoring well installation, water sample collection, water level data collection and air monitoring. Although extensive soil borings and subsurface investigations were completed at the Charlevoix site, no discrete source of contamination was found. In

addition, no contaminants were found in the soil zone in any of the soil borings. The final Remedial Investigation report was issued on February 7, 1985.

Data collected during the RI in December 1983 indicated that concentrations of TCE and PCE in the groundwater moving toward the water supply well were much higher than previously measured. A Focused Feasibility Study (FFS) was initiated in early 1984 because of the potential health hazard to Charlevoix residents presented by the contaminated drinking water supply. The purpose of the FFS was to evaluate Initial Remedial Measures (IRMs) that could be implemented to provide a safe drinking water supply. The FFS recommended that a Lake Michigan water intake structure and filtration/flocculation plant be constructed to provide Charlevoix residents with a new water supply.

On June 12, 1984, a Record of Decision (ROD) was signed which approved an IRM for an alternate water supply to replace the contaminated municipal well. The selected IRM consisted of a Lake Michigan water intake structure located 1,400 feet off the shore of Lake Michigan and a 2.4 million gallons per day water treatment plant. The IRM concluded that upon completion of the construction, the City would have a clean water supply and that the existing municipal well should be abandoned.

The objective of the second major phase of RI field work was to locate and identify the source of the TCE and more extensively map the PCE plume. The results from December 1983 indicated that the highest concentrations of TCE in groundwater occurred in the vicinity of the Charlevoix Middle School.

The results were less conclusive regarding the origin of the PCE contamination, but indicated an area upgradient of the intersection of Hurlbut and State Streets. There are a number of former, or currently operating commercial facilities upgradient where PCE may have been used, including dry cleaners and the Charlevoix Airport.

Although extensive soil borings were completed in the Middle School area during Phase II of the RI, a discrete source of contamination such as an underground tank or buried drums was not found. In addition, no contamination was detected in any of the soil samples taken from the borings in the unsaturated zone above the water table. These results indicate that there is no current, identifiable source of contamination and that the origin of the contaminated groundwater was either a single spill or a source that was subsequently removed.

Fill material was found in soil samples collected from borings in the area of the school playground to depths of up to 14 feet. The existence of this fill was confirmed in discussions with Charlevoix School District personnel. At one time, a wing

of the Middle School was located in the area where the playground is now located. This wing was demolished in the mid-1950's. The fill material was deposited in the basement of the old wing. A new wing was added to the school in the late 1950's. TCE may have been spilled during the demolition or construction activities. TCE was commonly used as a degreasing solvent in the 1950's and may have been used with the construction equipment. The total estimated mass of TCE in the groundwater plume was 95 kilograms (16 gallons of 100% TCE), indicating that a small spill could have been the source of the contamination.

The data obtained during the RI permitted an estimate of the extent of groundwater contamination to be made. The areal extent of TCE contamination greater than 100 ppb was approximately 243,000 ft<sup>2</sup> or approximately 5.6 acres. The area contaminated with TCE above the 10<sup>-6</sup> excess lifetime cancer risk level (2.7 ppb) was approximately 3,000,000 ft<sup>2</sup> or 70 acres. The volume of water contaminated with TCE at concentrations greater than 2.7 ppb was 393 million gallons. PCE contamination greater than 25 ppb covered an area approximately 350,000 ft<sup>2</sup> or approximately 8.0 acres. The southern end of the plume was undefined, so that only rough estimates of volume can be made. An estimate of the volume of water contaminated with PCE above the 10<sup>-6</sup> risk level (.88 ppb) was 260 million gallons.

The area and volume of water contaminated with TCE and PCE at concentrations above 10 ppb but less than 100 ppb was difficult to define because groundwater samples taken from nearly every boring and monitoring well detected some level of contamination. There are two separate contaminant plumes, one of TCE and one of PCE. Each plume consists of that single contaminant. No other compounds were consistently detected.

Based on the findings of the Remedial Investigation and risk assessment, the objective of remedial action at the site was identified as minimizing the potential risk to the public from direct consumption of the contaminated groundwater through inadvertent use of private wells by individuals unaware of the hazard. This objective is consistent with the IRM ROD which permanently relocated the source of the municipal water supply.

All Feasibility Study alternatives which were evaluated concerned actions which managed the migration of contaminated groundwater. The alternatives evaluated consisted of no action; extraction of the contaminated groundwater by pumping; treatment of extracted groundwater; and the selected alternative; limited action, which included groundwater monitoring and restrictions on groundwater use after the construction of the water treatment plant was completed.

The limited action alternative will allow the contaminated

groundwater plumes to naturally migrate and disperse into Lake Michigan. It is estimated that the contaminated groundwater will be purged in approximately 50 years. A semi-annual groundwater sampling and analysis program will monitor the plume throughout the purging process.

During the purging process, institutional controls preventing the installation and use of private wells in the contaminated area will be required. The District Health Department #3 administers an existing well permitting program in Charlevoix County, and has expressly prohibited the installation of new wells in the City of Charlevoix since the discovery of the TCE and PCE contamination. In addition, the City of Charlevoix prohibits the use of private domestic drinking water wells within the City limits. The entire City is served by the municipal water supply.

The concentrations of TCE and PCE expected in the nearshore surface waters of Lake Michigan as a result of the continued release of the contaminant plumes under the natural flow conditions of the selected alternative are 0.008 ppb and 0.01 ppb respectively. This is a conservative estimate based on the "average" levels of TCE and PCE in the area-wide plumes, rather than the much lower concentrations measured in the groundwater adjacent to Lake Michigan. The Federal criteria for the protection of freshwater aquatic life above which acute effects in aquatic life could occur are 45,000 ppb for TCE and 5,280 ppb for PCE. These are several orders of magnitude higher than the estimated concentrations for TCE and PCE in the lake water. The criterion for long-term protection of aquatic life from PCE is 840 ppb. EPA has not established a long-term criterion for TCE. A comparison of the acute and chronic standards to the expected concentrations of TCE and PCE clearly indicates that the selected alternative will not adversely affect aquatic life in Lake Michigan.

The Record of Decision was approved by the Regional Administrator on September 30, 1985. The State of Michigan concurred with the ROD on December 4, 1986.

In accordance with the IRM, the U.S. EPA on June 4, 1984 submitted an Interagency Agreement (IAG #DW96930873-01) to the U.S. Army Corps of Engineers (USACE). The USACE would review the design of the intake structure prepared for the City of Charlevoix by McNamee, Porter and Seeley (MPS), complete the design drawings for the intake structure and prepare bidding documents for the intake structure construction. The USACE was also required to select an architecture/engineering firm to complete the design of the water treatment plant (MPS was subsequently selected as the design firm). At that time, the intake structure was designated as Phase I and the water treatment plant was designated as Phase II.

The water intake design was prepared for the City in conjunction with a bond issue for a new water intake structure and treatment plant which failed to pass in 1983. Subsequently, the MDPH issued an administrative action to insure the City's compliance with the Safe Drinking Water Act. This action was put on hold once U.S. EPA implemented the IRM.

The U.S. EPA and the State of Michigan executed a State Superfund Contract (SSC) for the IRM on June 12, 1984. The SSC provided that the State pay 10% of the IRM costs and assume responsibility for all operation and maintenance requirements. The SSC was subsequently amended to increase the State's costs based on actual awarded construction contracts.

#### Remedial Construction Activities

In August 1984, a second IAG (#DW96930959-01) was executed. This agreement pertained to the construction of Phase I and Phase II. The Phase I (water intake structure) construction contract was awarded to South Shore Equipment Company on September 10, 1984. The contract was subsequently terminated for failure to pursue the work with the diligence necessary for completion within the time specified in the contract. The surety, Union Indemnity Insurance Company, took over the project on March 15, 1985. The agreed upon completion date was set as June 15, 1985. On July 26, 1985 this contract was terminated. Union Indemnity had proven to be financially unstable and, in a separate proceeding, the New York Supreme Court had ordered the liquidation of the Union's assets. The remaining work on Phase I was advertised and awarded to Ryba Marine Construction, Inc. on August 4, 1985. All work was completed on time on November 11, 1985. The work performed was accepted by the USACE on September 17, 1986.

The Phase II (water treatment plant) construction contract was awarded to Comstock Construction Company on August 15, 1985. The City of Charlevoix began operating the plant on March 31, 1987. All site work and punchlist work was completed on October 6, 1987. A minor modification (rip-rap along the shoreline to protect the plant) changed the completion date to October 25, 1988. The work performed was accepted by the USACE on January 4, 1989.

The USACE submitted a Remedial Action Report on January 23, 1989. The report signified the successful completion of all construction activities. The final construction cost of the remedial action was \$3,105,832.64.

#### Water Intake Backwash Issue

Soon after operation of the lake water intake and water treatment plant began, the City experienced a capacity

diminishment problem. The design for the intake structure was innovative in that it called for the intake to be placed in a dug out depression in the lake bottom. Specially chosen fill material was placed over the intake structure. The fill material was to act as a pre-filter, thus allowing a pre-filtration step to be omitted from the water treatment train in the on-shore plant. However, once the system was in operation, the fill material tended, apparently, to become clogged with the fine sands of the surrounding lake bottom. The plugging occurred most frequently during periods when Lake Michigan was rough and water demand was high. The intake was backwashed to correct the problem, however this proved to be a very temporary solution. Depending on the weather and water demand, the alleviation of capacity diminishment would last anywhere from 2 months to 2 hours.

At the City's request, the Region reviewed the problem in late 1988. Upon completion of the review, the stance taken by the Region was that this was an Operation and Maintenance (O&M) problem. Since the Region had fulfilled its obligation to fund the first year of O&M, any subsequent action taken to address this O&M problem, so it was reasoned, was the legal responsibility of the State.

The problem continued, and backwashing appeared to be less and less effective. In 1990 the MDPH declared the system to be an unreliable source of water for the City. The Region was subsequently asked to re-evaluate its decision. New data was submitted by the City, attesting to the chronic nature of the problem. In addition, the design firm, MPS, presented evidence that irregularities encountered during construction could have contributed to the problem. The Region, upon reviewing the new data, concluded that some combination of unforeseen conditions, present during construction and/or routine operation, rendered the structure unable to perform as envisioned. In any case, the intake system could clearly not be considered a properly functioning remedy. Therefore, as this was either a design or construction problem, or a combination, U.S. EPA would undertake to correct the situation. Subsequently, the Region entered into an IAG with the USACE (#DW96947553-0) to oversee the augmentation of the intake structure so that the original design capacity could be reliably achieved. A sum of \$600,000 was obligated for this purpose.

The new intake was designed by MPS, and put out for bid in late 1991. The contract for construction of the new intake was awarded to Luedtke Engineering on January 17, 1992. Actual construction took place during April and May of 1992. The contractors completed construction (demobilized) on June 3, 1992. The City subsequently began full scale operation of the new intake. On September 1, 1992, U.S. EPA received a letter from the City stating that the new water intake was functioning very

well.

On September 24, 1992, the USACE submitted a Remedial Action Report signifying successful completion of intake construction activities. The total contract cost for this action was \$408,297.55. The work performed was accepted by the U.S. EPA Regional Administrator on October 13, 1992.

A Preliminary Close-Out Report was completed for this site and was signed on September 16, 1992.

### Community Relations Activities

Copies of the Feasibility Study (FS) were made available to the community on June 10, 1985. Three locations served as repositories within the City: Charlevoix City Hall, District Health Department No. 3, and the Charlevoix Public Library. The EPA placed an advertisement in the local newspaper on June 3, 1985 which announced the availability of the FS and the start of the 3-week public comment period.

A public meeting was held on June 27, 1985 at the Charlevoix City Hall. Only six residents attended the meeting. Representatives of the EPA, MDNR, and local government were present. The EPA presentation explained the purpose of the FS, presented the results of the endangerment assessment under the no action alternative, and described the alternative recommended by EPA. Questions regarding the project were also answered. There were no formal public comments made. The public comment period ended on July 1, 1985. No written comments were submitted.

The community relations program was led by the State. Community relations responsibility was delegated to the MDNR through a Multi-site Cooperative Agreement which was executed on May 30, 1985. The Agreement also covered 7 other Superfund sites in Michigan. When this Agreement expired, a new Cooperative Agreement (CA), executed in June 1987, provided for the continuation of State-led community relations tasks in Charlevoix.

## **II. QUALITY ASSURANCE PROJECT PLAN**

On December 4, 1986, the MDNR concurred with the U.S. EPA's Record of Decision, which had been signed on September 30, 1985. The concurrence letter also indicated that the MDNR would be willing to undertake the periodic monitoring program outlined in the ROD. The June 1987 CA delegated O&M of the facility to the State. The semi-annual sampling of groundwater wells and Lake Michigan surface water to monitor the contamination plume as it attenuates to Lake Michigan was also delegated under the CA. The MDNR submitted a Quality Assurance Project Plan (QAPjP) to



conduct sampling and analysis which was approved on November 30, 1987. The first sampling round using the QAPjP procedures was taken in January 1988.

A QAPjP was determined not to be necessary for O&M of the water treatment facility. The reasons for this determination were:

1. The plant operation and related laboratory analysis are intended for the supply of potable water drawn from Lake Michigan for human consumption. The plant is not treating contaminated water in any fashion.
2. The analysis will be performed by a certified laboratory in compliance with the Safe Drinking Water Act.
3. Sample analysis will not be used as evidence for cost recovery action against a potentially responsible party.

The EPA Region V Quality Assurance Office concurred that a QAPjP was not needed.

### III. MONITORING RESULTS

The MDNR conducts semi-annual ground and surface water monitoring in accordance with the ROD and the CA. The City personnel do not conduct the sampling and monitoring O&M. Analysis from the January 1988 sampling event showed a four-fold decrease in TCE concentrations since January 1987. The TCE plume, therefore, discharges into Lake Michigan at concentrations of less than 10 ppb. The dilution and enhanced volatilization due to wave action result in non-detectable levels of TCE in Lake Michigan.

### IV. SUMMARY OF OPERATION & MAINTENANCE

O&M for this site consists solely of those activities necessary to run the water treatment plant. In December 1988, under the second IAG with the USACE, MPS prepared and delivered an Operation and Maintenance Manual for the Charlevoix Water Treatment Plant. U.S. EPA funded 90% of the cost associated with the first year of O&M activities. This one year period ended on June 30, 1988. The State provided the remaining 10% during the first year. Thereafter, the State was to provide for all O&M activities. Actual O&M of the water treatment plant is conducted by the City's water treatment plant operators. The State has a contract with the City to provide these services. This arrangement remained in place, unaltered, following the

construction of the new intake.

It is estimated that the contaminated groundwater will be purged in approximately 50 years. The groundwater sampling and analysis program will monitor the plume throughout the purging process. Currently, and during the remainder of the purging process, institutional controls preventing the installation and use of private wells in the contaminated area are and will continue to be in place at the County and City jurisdictional levels.

#### **V. PROTECTIVENESS**

All completion requirements for this site have been met as specified in OSWER directive 9320.2-3A. Sampling has verified that the two plumes are assimilated into Lake Michigan at levels which are un-detectable. The City of Charlevoix now has a safe, clean, and reliable drinking water supply (with all citizens being served by the water system). All recommendations given in the ROD of September 30, 1985 have been met. The recommendations were as follows:

- 1) Allow the contaminant plumes to discharge under natural flow conditions to Lake Michigan.
- 2) Continue long-term monitoring of the plumes during the natural purging period.
- 3) Institutional restrictions on the installation of private wells in the contaminated aquifer will be enforced by local health officials.

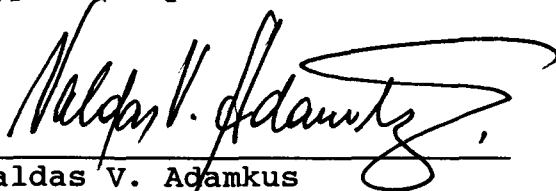
Given the continued implementation of these recommendations and the current understanding of the Charlevoix Municipal Well site, no further Superfund response is appropriate in order to provide protection of human health and the environment.

#### **VI. FIVE YEAR REVIEW**

According to the December 29, 1989 amendment to OSWER Directive 9320.2-3A ("Procedures for completion and Deletion of National Priorities List Sites (NPL)"), the final Charlevoix ROD, although technically a No Action ROD, is actually defined as a Limited Action ROD. As such, a five year policy review pursuant to OSWER Directive 9355.7-02 ("Structure and Components of Five Year Review") is required and will be completed in 1993.

**Superfund Site Close-Out Report  
Charlevoix Municipal Well  
Charlevoix, Michigan**

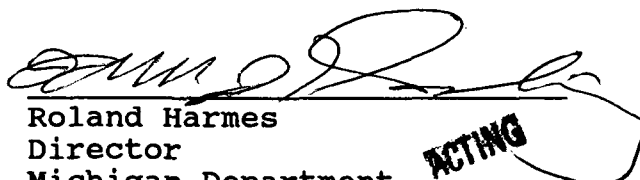
Approved By:

  
Valdas V. Adamkus  
Regional Administrator  
U.S. EPA, Region V 7/12/93

Disapproved By:

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